Intermetallic Alloy Development for the Steel Industry

Ni_3Al alloys have exceptional high temperature strength and corrosion resistance

Objective: Enable increased energy efficiency and process efficiencies in the steel industry through the application of intermetallic alloys

Benefits:
- energy savings of up to 32 T Btu by 2010
- improved productivity and product quality
- improved environmental benefits

Austenitizing furnace rolls in USX Corporation

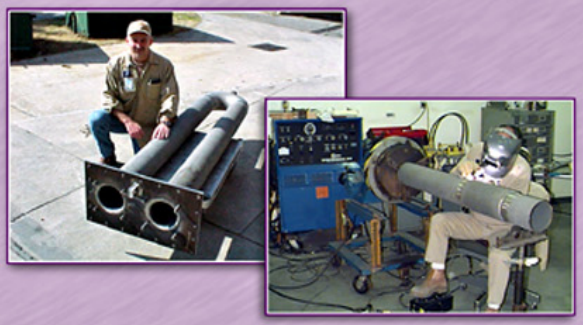
Jim Brinsky of Weirton Steel Corporation inspects nickel aluminide (IC221M) seal rolls for hydrogen steel strip annealing furnace

Nickel aluminide rolls show no sign of blistering in austenitizing furnace at 160" plate mill in Bethlehem Steel Burns Harbor Plant

Guide rolls in hydrogen steel strip annealing furnace — Weirton Steel Corporation

Heat treating tray in steel carburizing furnace at Timken Corporation

Nickel aluminide radiant burner installed at Weirton Steel Corporation



Tubes were successfully welded

Participants:

R&D Organization ornl

Licensees/Producers

alloy engineering & casting company · Sandusky International · Thermadyne Stoody · United Defense · Polymet Corporation · Alcon

Steel Producers

Bethlehem Steel · Timken · USS · Weirton Steel Corporation

Steel Users

Caterpillar · Delphi Saginaw Steering Systems · Ford

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Large energy savings and improvement in productivity and quality of steel can be achieved by use of intermetallic compounds in steel manufacturing processes.

Goal: The goal is to develop intermetallic alloys for use in steel processes and expand the commercial acceptance of intermetallic alloys for rolls in austenitizing furnaces, annealing furnaces, continuous caster, radiant burner tubes, and steel carburizing furnace applications.

Large energy savings can be achieved in steel industry by the development and application intermetallic alloys. It is estimated that by 2010 the total per year energy savings will be 32 trillion BTU. Efficiencies result from not having to (1) shut down austenitizing furnaces for frequent grinding of current rolls to remove blister; (2)shut down continuous casters to grind roll surfaces because of thermal fatigue cracking; (3) replace rolls as frequently in austenitizing furnaces and continuous casters and thus casting significantly fewer rolls; and (4) remelt and process out-of-specification steel plates due to marring by blisters on current rolls in the austenitizing furnaces or continuous cast systems. Improved productivity can be reached from the minimization of furnace down time. Improved quality is possible by eliminating the chance of scratching the plates. Annealing furnaces in the continuous processing of steel sheet are typically by the use of radiant burner tubes. Current tubes fail by creep deformation and oxidation mechanisms. Nickel aluminide seal rolls are also being tested and evaluated in hydrogen strip annealing furnaces. Energy savings in furnaces can thus be achieved by extending component life and increased process efficiency.

Six licensed companies are manufacturing the nickel-aluminide components. Steel industry producer and user partners include **Bethlehem Steel Corporation, The Timken Company, U.S.. Steel, and Weirton Steel Corporation.**

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